

Ice Safety Systems

The Breakthrough That Makes Water Use in Dry Coolers Possible

Improving Efficiency by Eliminating Glycol

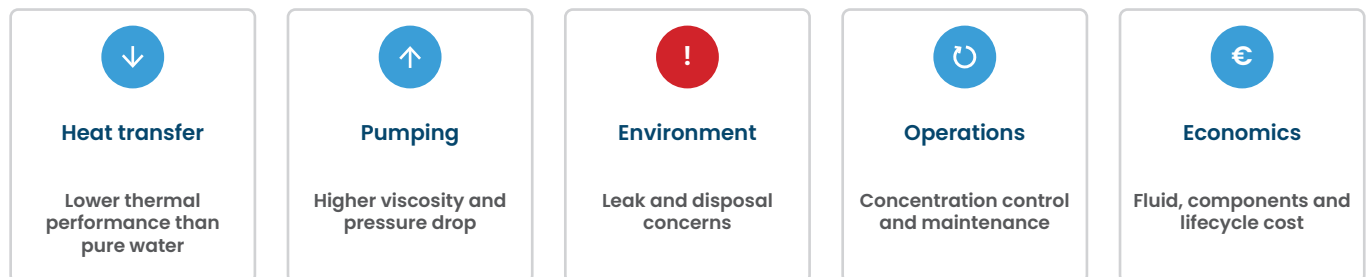
In industrial cooling systems, data centers, and HVAC applications, glycol has traditionally been used to protect outdoor hydraulic circuits from freezing. However, this solution involves a significant compromise: the system is designed around a fluid with lower thermal performance than water.

With **Ice Safety Systems (ISS)**, developed by the engineering team at Enex Technologies, it becomes possible to leverage the benefits of pure water while maintaining maximum freeze protection for outdoor finned coils and dry coolers.

Why Glycol Is a Limiting Factor

While glycol provides freeze protection, it also introduces several drawbacks that negatively impact overall system efficiency.

The Glycol penalty



In other words, the entire system is designed and operated around a less efficient heat transfer fluid, directly affecting operating costs and energy performance.

The Opportunity: Using Pure Water

Water is the most effective heat transfer fluid available for thermal exchange applications. Its properties deliver superior performance from both thermal and hydraulic perspectives.

Benefits of Water Compared to Glycol

- **Higher Thermal Efficiency**
Water provides more effective heat transfer, allowing the full utilization of the available heat exchange surface and temperature differentials.
- **Reduced Pumping Energy Consumption**
Its lower viscosity reduces pressure drops and the energy required to circulate the fluid.
- **Lower Operating Costs**
No periodic concentration checks or glycol replacement activities are required.
- **A Strategic Advantage for Data Centers**
In large cooling installations, such as a 1 GW data center, the volume of circulating fluid can reach approximately 20,000 m³. With a solution containing 25% propylene glycol, around 5,000 m³ of glycol would be required, representing an investment that can reach tens of millions of euros.



The Real Problem Is Not Water. It Is Freezing.

When water freezes inside a finned coil, the issue is not simply the formation of ice. During the freezing process, ice plugs can form inside the tubes, trapping liquid water. The volume expansion associated with ice formation generates localized pressure peaks that can deform or even rupture the tubing. The real engineering challenge is therefore ensuring that the system reacts before these overpressures can damage the equipment.

Ice Safety Systems: Two Approaches to Freeze Protection

Mechanical ISS Passive Coil Protection

Mechanical ISS acts after freezing has already begun. A network of capillary tubes connects the critical sections of the coil and transfers excess pressure to a common safety system equipped with a relief valve. This allows pressure to be controlled and limited before it can cause tube deformation or failure.

Advantages of Mechanical ISS

- No electrically powered emergency sequence required.
- Simple and reliable architecture.
- Passive management of overpressure.
- Technology developed from field experience with approximately 5,000 installed units.



Forced ISS Active and Preventive Freeze Protection

Forced ISS intervenes before potentially damaging ice can form.

Through a network of temperature sensors, a dedicated controller detects freeze risk and automatically initiates a protection sequence that includes:

- Freeze risk detection.
- Fan shutdown.
- Coil isolation.
- Gravity drainage.
- Controlled-pressure nitrogen injection.
- Purging sequence.
- System closure and securing.
- Continuous system status monitoring.

At the end of the procedure, the coil is completely drained of water and maintained under a slight nitrogen overpressure, eliminating the risk of freezing.



Ideal Applications

Ice Safety Systems are suitable for a wide range of applications where energy efficiency and reliability are critical:

- Data centers
- Manufacturing industry
- Food processing
- Industrial refrigeration
- District heating
- Hospitals and healthcare facilities
- Shopping centers
- Office buildings
- Airports
- Swimming pools
- Sports facilities and ice rinks